CLAIMS

1. A hydraulic device for back and forth movement as well as locking of a machine part, in particular for opening, closing and clamping the half-molds of an injection molding tool of an injection molding machine, comprising a cylinder (1) in which a first pressure space (6) with a pressure medium is provided, a first piston (primary piston) (2), wherein the primary piston (2) includes one or more piston rods (11) and can float in the pressure medium located in the first pressure space (6), and a second piston (secondary piston) (7) axially movable in the cylinder (1), characterized in that the secondary piston (7) has recesses in which the piston rods (11) of the primary piston (2) are movable, and that the opposing sides of the primary piston (2) and secondary piston (7) have surfaces (40, 41) which can be brought to impact one another.

2. Hydraulic device according to claim 1, characterized in that the opposing sides of the primary piston (2) and secondary piston (7) are so configured as to form a second pressure space (43), when the contact surfaces (40, 41) between the primary piston (2) and secondary piston (7) touch one another, and that a passageway (29) feeds into this pressure space (43) and is provided for decompressing the pressure medium trapped in this pressure space (43).

3. Hydraulic device according to claim 2, characterized in that a negative pressure can be generated in the second pressure space (43) formed between the primary piston (2) and secondary piston (7).

4. Hydraulic device according to one of the claims 1 to 3, characterized in that the contact surface (40) of the primary piston (2) and the contact surface (41) of the secondary piston (7) are conical.

5. Hydraulic device according to one of the claims 1 to 4, characterized in that the secondary piston (7) has a first section (8) sliding on the inner wall of the cylinder (1) and demarcating the first pressure space (6) on its side (21) facing the primary piston (2), and that the secondary piston (7) further includes a second section (9) in prolongation of the first section (8) and having a diameter which is smaller than the inner diameter of the cylinder (1) in this area so that a third pressure space (10) in the form of an annular gap is defined between the cylinder (1) and the secondary piston (7).

6. Hydraulic device according to one of the claims 1 to 5, characterized in that the cylinder (1) has a first section (37) with a first inner diameter (4) and a second section (38) with a second inner diameter (39), that the region passed by the secondary piston (7) during its movement is located within the second section (38), and that only the second section (38) has a surface to satisfy hydraulic requirements.

7. Hydraulic device according to one of the claims 1 to 6, characterized in that the second section (9) of the secondary piston (7) partly projects beyond the cylinder (1).

8. Hydraulic device according to one of the claims 1 to 7, characterized in that the piston rod (11) of the primary piston (2) has a first section (13) which slides in the recess (12), that the piston rod (11) further includes a second section (14) in prolongation of the first section (13) and having a smaller diameter than the first section (13) so that a fourth pressure space (18) in the form of an annular gap is defined between the section (14) of the piston rod (11) and the secondary piston (7), and that the second section (14) is guided through a bore (15) on the tool-side end of the recess (12) of the secondary piston (7).

9. Hydraulic device according to one of the claims 1 to 8, characterized in that the cylinder (1) has an end which faces the moving machine part (16) and has an end piece (17) which is configured as support platen of a three-platen clamping unit of an injection molding machine, and that the piston rod (11, 14) is securable to the moving platen (16) of this clamping unit.

10. Hydraulic device according to one of the claims 1 to 8, characterized in that the primary piston (2) has a side which is distal to the secondary piston (7) and has a further piston rod (46) defined by a diameter which is smaller than the diameter of the first piston rod (11), and that the further piston rod (46) projects beyond the cylinder (1).

11. Hydraulic device according to claim 10, characterized in that the cylinder (1) has an end which faces the injection molding tool (24, 42) and has an end piece (17) which is configured as a platen of a two-platen clamping unit of an injection molding machine, and that the further piston rod (43) is securable to the other platen.

12. Clamping unit for an injection molding machine, comprising a support platen (17), a fixed (44) and a moving (46) platen, as well as one or more hydraulic devices according to one of the claims 1 to 9 for operating the moving platen (16).

13. Clamping unit for an injection molding machine, comprising a support platen (17), a fixed (44) and a moving (13) platen, as well as one or more hydraulic devices according to one of the claims 5 to 9, wherein the cylinder (1) is secured to the support platen (17) or an end piece of the cylinder (1) is configured as support platen (17), wherein the support platen (17) has bores (55) through which the secondary piston (7) can travel, wherein the piston rod (11) is mounted to the moving platen (16), and wherein the third pressure space (10) can be hydraulically blocked during the closing and opening movements.

14. Clamping unit for an injection molding machine, comprising a support platen (17), a fixed (44) and a moving (13) platen, as well as one or more hydraulic devices according to one of the claims 1 to 9, wherein the cylinder (1) is secured to the support platen (17) or an end piece of the cylinder (1) is configured as support platen (17), wherein the support platen (17) has bores (55) through which the secondary piston (7) can travel, wherein the piston rod (11) is mounted to the moving platen (16), and wherein at least one auxiliary cylinder (56) is/are provided on the support platen (17) and/or on the fixed platen (44) whose piston rod(s) (57) is/are mounted to the moving platen (16).

15. Clamping unit according to claim 14, characterized in that the first pressure space (6) is hydraulically blockable for the closing movement, the third pressure space (10) is connectable to a pressure medium source (27) and the auxiliary cylinder (56) can be idle.

16. Clamping unit according to claim 14, characterized in that the first pressure space (6) is hydraulically blockable for the closing movement, and the auxiliary cylinder (56) as well as the third pressure space (10) are connectable to a pressure medium source (27).

17. Clamping unit according to one of the claims 14 to 16, with the auxiliary cylinder (56) provided on the support platen (17), characterized in that the first pressure space (6) is hydraulically blockable for the opening movement, the third pressure space (10) as well as the first auxiliary pressure space (59) in the auxiliary cylinder (56) are hydraulically relieved, and the second auxiliary pressure space (60) in the auxiliary cylinder (56) is connectable to a pressure medium source (27).

18. Clamping unit according to one of the claims 14 to 16, with the auxiliary cylinder (56') provided on the fixed platen (44), characterized in that the first pressure space (6) is hydraulically blockable for the opening movement, the third pressure space (10) as well as the first auxiliary pressure space (60') in the auxiliary cylinder (56') are hydraulically relieved, and the first auxiliary pressure space (59') in the auxiliary cylinder (56') is connectable to a pressure medium source (27).

19. Clamping unit for a two-platen injection molding machine, comprising a fixed (44) and a moving (16) platen as well as one or more hydraulic devices according to claim 10 and 11 for operating the moving platen (16), wherein the cylinder (1) is mounted to the fixed platen (44) or an end piece of the cylinder (1) is configured as fixed platen (44), and wherein the second piston rod (46) is guided through the fixed platen (44) and attached to the moving platen (16).

20. Clamping unit for a two-platen injection molding machine, comprising a fixed (44) and a moving (16) platen as well as one or more hydraulic devices according to claim 10 and 11 for operating the moving platen (16), wherein the cylinder (1) is mounted to the moving platen (44) or an end piece of the cylinder (1) is configured as moving platen (44), and wherein the second piston rod (46) is guided through the moving platen (44) and attached to the fixed platen (16).

21. Clamping unit according to claim 19 or 20, characterized in that the cylindrical recess (12) in the secondary piston (7) has an end which is distal to the primary piston (2) and closed by an end piece (49) so that a pressure space (51) is formed in the secondary piston (7).

22. Clamping unit according to claim 21, characterized in that the third pressure space (10) between the secondary piston (7) and the cylinder (1) is hydraulically blockable during the closing and opening movements.

23. Clamping unit according to claim 21 or 22, characterized in that the pressure space (51) in the secondary piston (7) is decompressible during the closing movement and connectable to a pressure medium source (27) for the opening movement.

24. Clamping unit according to claim 19 or 20, characterized in that the cylindrical recess (12) in the secondary piston (7) has an end which is distal to the primary piston (2) and open, and that at least an auxiliary cylinder (56, 56') is/are provided on the fixed (44) and/or the moving (16) platen.

25. Clamping unit according to claim 24, characterized in that the first pressure space (6) is hydraulically blockable for the closing movement, the third pressure space (10) is connectable to a pressure medium source (27) and the auxiliary cylinder(s) (56, 56') can be idle.

26. Clamping unit according to claim 24, characterized in that the first pressure space (6) is hydraulically blockable for the closing movement, and the auxiliary cylinder(s) (56, 56') as well as the third pressure space (10) are connectable to a pressure medium source (27).

27. Clamping unit according to one of the claims 24 to 26, characterized in that the first pressure space (6) is hydraulically blockable for the opening movement, and the third pressure space (10) is decompressible, and that the auxiliary cylinder(s) (56, 56') are so disposed and hydraulically actuatable that the greater surface of the piston(s) (58, 58') is/are subject to a pressure medium.